
Atmel AT06015: Production Programming of Atmel Microcontrollers

Atmel MCU

Description

Atmel® microcontrollers are flash based, and the program memory therefore needs to be programmed with a firmware image for the end-product to operate as desired. During *development* it is recommended to use the combined programming and debugging tools from Atmel, which integrates directly in the Atmel Studio IDE. For *production programming* it is however recommended to use 3rd party programming tools that are intended for industrial environments. Another option is to order the microcontrollers preprogrammed from Atmel or from a programming house.

Features

- Atmel programming solutions
- 3rd party programming solutions
- Programming services

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1. Atmel Development Programming Tools

To identify the right programming and debugging tool for a microcontroller from Atmel: Go to the microcontroller product page from e.g. the top menu, and on the product page select the “Tools” tab. This will show a list of development tools for the product. The **SAM-ICE** supports programming and debugging of all Atmel SAM microcontrollers. The SAM devices can also be programmed through the **SAM-BA** bootloader (various interface options). The **ATMEL-ICE** is a programming and debugging tool that support all of the Atmel AVR microcontroller products and Atmel SAM microcontrollers. AVR microcontrollers can also be done using the **AVRISP mkII**. Note however that the **AVRISP mkII** do not support debugging.

Please note that the programming tools from Atmel are not recommended for production programming: they are designed for development environments. SAM-BA can be considered an exception, as it does not depend on physical tool, but software only.

SAM-ICE: <http://www.atmel.com/tools/ATMELSAM-ICE.aspx>

SAM-BA programming: <http://www.atmel.com/tools/ATMELSAM-BAIN-SYSTEMPROGRAMMER.aspx>

AVRISP mkII: <http://www.atmel.com/tools/avrispmkii.aspx>

ATMEL-ICE: <http://www.atmel.com/tools/ATATMEL-ICE.aspx>

Figure 1-1. Tools Tab on Microcontroller Product Page

The screenshot displays the Atmel website's product page for SAM D20 ARM Cortex-M0+ Microcontrollers. The page features a navigation bar with links to Worldwide, Communities, myAtmel, Log In, and Cart. A secondary navigation bar includes Products, Applications, Technologies, Design Support, About Atmel, and Buy. The main content area is titled "SAM D20 ARM Cortex-M0+ Microcontrollers" and includes a breadcrumb trail: Home > Products > Microcontrollers > ARM-based Solutions > SAM D20 MCUs. A sidebar on the left lists various microcontroller families, with "SAM D20 MCUs" highlighted. The main content area has tabs for Overview, Product Search, Documents, and Tools (which is active). Below the tabs is a large image of a SAM D20 microcontroller chip. To the right of the image is a "Get Started" section with links for Start Now, Contact Sales, Request Samples, and Sign-up for News. Below the image is a "Tools and Software Atmel SAM D20" section with a "Recommended" filter. This section lists two items: "STK600" (Starter Kit for Atmel 8-bit and 32-bit AVR Microcontrollers) and "STK600-RC064SAM-72" (Routing card for Atmel SAM D20 64-pin TQFP and QFN socket). Each item has a "Details" link. On the right side of the page, there is a "Related Items" section with links to Atmel Studio 6, Atmel MCU Xplained Pro Kits, Atmel MCU Xplained Kits, Atmel Embedded MPU Portfolio, Third Party Support, University Program, Atmel ARM-based FAQs, Technical Support, What's Changed, and Mature Devices.

2. Preprogrammed Microcontrollers

Atmel and many Atmel distributors offer preprogrammed microcontrollers. In this case the binary image is provided to Atmel or the distributor. This solution is obviously less flexible if changes are made frequently to the preprogrammed firmware and does have MOQ implications, but can have advantages related to reduced production time for the end-product.

To request preprogramming of Atmel microcontrollers contact Atmel Customer Service or your local Atmel sales office or your distributor. Note that preprogramming services may require orders of a certain size.

Find your local Atmel sales office on this Atmel web page:

http://www.atmel.com/buy/contact_us.aspx?contactType=Atmel%20Sales%20Office

3. Third Party Programming Tools

For production programming, and e.g. to perform in-system calibration or parameter customization for the end-product it is recommended to use professional programming tools from a third party. The list of 3rd party programming tools in Table 3-1 includes programming solutions for use in both development and production. “Gang” programmers in this context refer to single and multi site programmers, where devices are inserted into the programming fixture to be programmed. This is in contrast to “In-system” programming where the device to program is mounted in the PCB while being programmed. Both kinds of programmers can thus be used in production environments, while in-system programmers are usually preferred for development purposes.

Table 3-1. Third Party Vendors of Programming Tools in Alphabetic Order

Company name	ARM support	AVR support	Programmer intended for	Gang	In-system
Advantech Equipment Taiwan ROC http://www.aec.com.tw/	Yes	Yes	Production (and development)	Yes	No
ASIX Czech Republic http://tools.asix.net/index.htm	Yes	Yes	Development and production	No	Yes
BP Microsystems USA http://www.bpmmicro.com/	Information missing: contact vendor				
Data I/O USA http://dataio.com	Yes	Yes	Production and development	Yes	No
Dataman UK www.dataman.com	Yes	Yes	Production (and development)	Yes	Yes
EE Tools, Inc USA www.eetools.com	Information missing: contact vendor				
ELNEC Slovak Republic http://www.elnec.com/	Yes	Yes	Production (and development)	Yes	Yes
Equinox Technologies United Kingdom http://www.equinox-tech.com/	Yes	Yes	Production, field-service and development	Yes	Yes

HI-LO Systems Taiwan ROC http://www.hilosystems.com.tw/	Yes	Yes	Production (and development)	Yes	No
IAR™ Systems Sweden http://www.iar.com/	Yes	No	Development	No	Yes
LEAP ELECTRONIC Taiwan ROC http://www.leap.com.tw/	Yes	Yes	Production (and development)	Yes	No
MIKROELEKTRONIKA Serbia http://www.mikroe.com/	No	Yes	Development	No	Yes
Phyton, Inc. Microsystems and Dev. Tools USA http://www.phyton.com	Yes	Yes	Production and development	Yes	Yes
Ronetix Austria http://www.ronetix.at/	Yes	Yes	Production and development	No	Yes
RPM Systems USA http://www.rpmsys.com/	Yes	Yes	Production and development	Yes	Yes
SEGGER Microcontroller Germany http://www.segger.com	Yes	No	Production and development, In-field-services	Yes	Yes
SMH Technologies Italy http://www.smh-tech.com	Yes	Yes	Production and development	Yes	Yes
System General Taiwan ROC http://www.sg.com.tw	Yes	Yes	Production (and development)	Yes	No
Xeltek USA http://www.xeltek.com/	Yes	Yes	Production and development	Yes	Yes

A general list of third party vendors for Atmel products can be found here (not limited to programming tools). It is recommended to refer to this list for the most recent information about third party tools.

ARM: <http://www.atmel.com/about/contact/default.aspx?contactType=Third+Party+Support+-+ARM&AreaOfExpertise=Programmers>

AVR: <http://www.atmel.com/about/contact/default.aspx?contactType=Third+Party+Support+-+AVR&AreaOfExpertise=Programmers>

4. Introduction of Listed Third Party Programming Offerings

The descriptions below are provided by the third party vendors listed in [Table 3-1](#) and contain additional information related to the programming products and the services these vendors offer. The descriptions below are therefore not reflecting recommendations by Atmel. The 3rd party vendors are listed in alphabetic order.

4.1 Advantech Equipment

The **Labtool-48UXP** is a universal programmer for development and low volume production, it supports most of the Atmel AVR® 8-bit MCUs up to 64 pin, in various packages including PLCC, SOIC, TSSOP, SOT23, TQFP, QFN, and QFP. In addition, through adapters, of up to 64 pins, it also supports Atmel ARM7TDMI MCU in 64 /48 pin in TQFP package, as well as the complete line of Atmel 8951-C1 and 51-C12 MCU.

The **Labtool-848XP** is a production gang programmer for high-density NOR Flash and Flash based MCU's with EEPROM. It supports parts of the 8-bit AVR family as well as the 89C51-1C and -2C MCU from Atmel. The **Labtool-848UXP** can also be customized with additional chip support upon customer request. In addition, if the default chip support is not sufficient, Advantech Equipment can be contacted to add the chip support with custom software.

Labtool-48UXP universal programmer: <http://www.aec.com.tw/lt-48uxp.htm>

Labtool-848XP gang programmer: <http://www.aec.com.tw/lt-848xp.htm>

4.2 ASIX

ASIX s.r.o. founded in 1991 has entered the development tools business in mid 90s. Since 2004 ASIX has been offering an In-System USB programmer, **PRESTO**, which supports many Atmel devices including AVR, '51 and ARM7TDMI MCUs, as well as serial EEPROM and Flash memories. In 2012, ASIX introduced a **FORTE** programmer, which offers more features and higher speed. Both programmers are primarily intended for development and service purposes, but many of them are also used for small and medium volume production (up to a couple of thousand units/day), typically with multiple programmers working in production lines. User-friendly and highly configurable software, called **UP**, supports production programming (serial number generator, remote control from command-line, Windows® messages, DLL library, etc.). Updates of **UP** and other software tools for **PRESTO** and **FORTE** are freely available. ASIX offers fast and effective technical support including new device implementation by a customer's request.

Company web page: <http://www.asix.net/>

4.3 BP Microsystems

No description available.

4.4 Data I/O

Data I/O is the world's leading provider of manual and automated device programming systems for Flash, Microcontroller and Logic devices. They serve electronics manufacturers around the world including OEM, ODM, and EMS and programming centers. Programming systems and value-added software solutions enable our customers to:

- Streamline programming - with their production processes
- Meet their specific quality requirements
- Ensure devices are programmed at maximum speed and with the highest quality

Data I/O creates best-in-class production solutions including:

PSV7000 Automated high-speed automated handler: www.dataio.com/PSV7000

RoadRunner3 Inline automated just-in-time programmer: www.dataio.com/RoadRunner

FlashPAK III manual programmer: www.dataio.com/FlashPAK

4.5 Dataman

With over 30 years of experience Dataman is a world leading provider of device programmers.

Dataman designs and sells products that stand out from the crowd and continue to provide market-leading solutions. Dataman offer a comprehensive range of programming solutions suitable for every requirement from design and development to large scale production.

Dataman currently supports over 80,000 devices (Nov 2013), with updates every 3 - 4 weeks adding 200 - 300 new chips. Support can be added for missing devices quickly and typically free of charge. Their universal programmers come as standard with a 3 year warranty, free life-time technical support and software updates.

4.6 EE Tools, Inc.

In 1992, EE Tools, Inc. started manufacturing a line of low-cost device programmers with an emphasis on MOS programming. EE Tools later developed a series of bipolar memory and logic programmers to complement the earlier products, and have since grown to become one of the most well-known universal device programmer manufacturers worldwide. From their headquarter in San Jose, through a network of distributors around the globe, they are able to keep on top of the expanding device programmer market, and provide customers with the best performance products and support. All products are backed with full technical support and free software updates for the product's lifetime.

Stand-Alone & Production Programmer: **MultiMax-8G+**

PC-driven Production Programmer via USB Interface: **ProMax-4G**

PC-driven Development Programmer via USB Interface: **TopMax2, ChipMax2**

EPROM Eraser: **Model 10, Chip-20**

EPROM Emulator via USB Interface: **EEROM-8U**

4.7 ELNEC

Eltec is a leading provider of solutions for programming memories, microcontrollers and other programmable devices in Europe. Eltec is committed to set a new standard in the industry by providing universal, highly reliable and cost effective programming solutions for devices in any package, whether programmed in a socket or through ISP on a circuit board. Eltec offers programming adapters: More than 800 models of universal, specialized and BGA adapters.

Their product range includes support for Atmel AVR 8-bit, AVR 32-bit, ARM based and 8051 microcontroller: Production programmers with multi-site concurrent programming for high volume manufacturers, and Universal programmers with single-site programming for developers and low volume manufacturers.

Production programmers: <http://www.eltec.com/products/production-programmers/>

Universal programmer: <http://www.eltec.com/products/universal-programmers/>

Programming adapters: <http://www.eltec.com/products/programming-adapters/>

4.8 Equinox Technologies

Equinox Technologies offers a comprehensive range of development, field-service and production programming tools, which support In-System Programming (ISP) of Atmel AVR and ARM® microcontrollers. The **EPSILON5-MK4** and **FS2009USB** portable programmers operate in 'standalone mode' and are therefore ideally suited to low-throughput production programming and field-service applications. The '**ISPnano - Series 3 / Series 4 GANG and MUX**' families of ISP programmers offer scalable, high-speed production programming solutions from 1 to 32 channels (gang mode) and 2 - 256 channels (multiplexed mode). All programmers offer comprehensive ESD and over-voltage protection.

EPSILON5-MKIV - Portable standalone ISP programmer: <http://www.equinox-tech.com/products/details.asp?ID=1575>

FS2009USB - Portable standalone ISP programmer: <http://www.equinox-tech.com/products/details.asp?ID=1561>

ISPnano Series 4 - Production ISP programmer: <http://www.equinox-tech.com/products/details.asp?ID=1538>

ISPnano-MUX 2/4/8 - Multiplexed ISP programmer: <http://www.equinox-tech.com/products/details.asp?ID=1498>

4.9 HI-LO Systems

HI-LO has been devoted to providing device programmers and programming / testing solutions, with reliable quality at a reasonable price for over 30 years. Their product range covers engineering, production programmers, automated device programming systems, and 3D lead / marking inspection systems. HI-LO is one of the market leaders regarding to Device Programming Equipment and Programming services in Pan Asia. (Hong Kong, Taiwan, China, Japan, etc.)

ALL-100A Universal Programmer is a high performance programmer for both engineering and production, which supports AVR UC3, AVR XMEGA®, megaAVR®, tinyAVR®, Battery Management MCUs, SAM3S MCUs, as well as SAM7S/SE MCUs.

FLASH-100 Gang Programmer is a multi-site high performance IC programmer, which can program up to eight pieces simultaneously, supporting AVR UC3, AVR XMEGA, megaAVR, tinyAVR, and SAM7S/SE MCUs.

ALL-100A Universal Programmer: http://www.hilosystems.com.tw/en/hilo_products/ALL-100A.aspx

FLASH-100 Gang Programmer: http://www.hilosystems.com.tw/en/hilo_products/Flash-100.aspx

4.10 IAR Systems

IAR Systems is the world's leading supplier of software tools for developing embedded systems applications. IAR Embedded Workbench® for ARM, a complete C/C++ compiler and debugger toolchain, which generate very efficient and reliable code for ARM devices. The in-circuit debugging probe **I-jet™** integrates seamlessly into IAR Embedded Workbench and is fully plug-and-play compatible. **I-jet** is available for microcontrollers based on any ARM core and supports JTAG, SWD, and SWV using the UART, as well as Manchester encoding modes. It features automatic core recognition, and direct download into the flash memory of most popular microcontrollers. **I-jet** has the capability of measuring target power consumption with a high degree of accuracy, and can supply the target board with power, entirely powered by USB. The Power Debugging capabilities can be extended with **I-scope**, which adds current and voltage measurement.

I-jet web site: www.iar.com/ijet

4.11 LEAP ELECTRONIC

Leap Electronic is deeply involved in the field of IC testing and programming equipment, supplying many series of products such as programmers, automation systems and logic analyzers. The range of programmers varies from universal to gang programmers, all of which can support both AVR and ARM. Moreover, LEAP ELECTRONIC also has the capability of providing programming services. Four branches are established in China, in order to provide customers well-organized and professional services. Email: overseas1@leap.com.tw.

Leaper-56 (Single-Site programmers): https://sites.google.com/site/leapleaptronixen/programmer_series/LEAPER-56

Leaper-456 (Development programmers): https://sites.google.com/site/leapleaptronixen/programmer_series/LP-456?pageUrlChanged=LP-456

AH-160 (Gang programmer series): https://sites.google.com/site/leapleaptronixen/automated_system/ah-160

AH-480 (Gang programmer series): https://sites.google.com/site/leapleaptronixen/automated_system/ah-480

4.12 MIKROELEKTRONIKA

mikroProg™ for AVR is a fast USB programmer supporting numerous AVR microcontrollers. It is supported with **mikroC**, **mikroBasic**, and **mikroPascal** compilers for AVR, but may also be used as a standalone programming tool. Outstanding performance, easy operation and low price are its top features. Elegant minimalistic design, clean matte white plastic finish and color indicator LEDs make **mikroProg** for AVR the first of its kind.

mikroProg for AVR web page: <http://www.mikroe.com/mikroprog/avr/>

mikroElektronika AVR compilers: <http://www.mikroe.com/avr/compilers/>

4.13 Phyton, Inc.

Phyton **ChipProg** line of device programmers for both development and production include single-site, gang parallel and in-system programmers. They provide extremely fast flash programming for Atmel SAM D20, SAM3, SAM4, AVR, C51, and AT89LP microcontrollers, memory devices and PLDs. Multiple Phyton programmers can be controlled from one computer for concurrent programming, from a friendly GUI, remotely from ATE via DLL, or in command line mode. The **ChipProg** software features script language and other tools for programming automation, allowing the writing of serial numbers and signatures into the chips. Adapters are available (BGA, QFN, QFP, TSOP, SOIC, PLCC, etc.).

ChipProg-ISP web page: http://www.phyton.com/htdocs/device_programmers/cp_isp.shtml

ChipProg-G41 web page: http://www.phyton.com/htdocs/device_programmers/cp_g41.shtml

ChipProg-481 web page: http://www.phyton.com/htdocs/device_programmers/cp_481.shtml

Device Finder web page: http://www.phyton.com/htdocs/asp/device_programmers/progsSearch.asp

4.14 Ronetix

RONETIX is an Austrian manufacturer of high-quality software toolkits, debug probes and programmers for wide range CPUs and Cores. Ronetix's JTAG Flash programmer **PEEDI** is a production and development solution for high speed programming on-board and on-chip FLASH devices on all ARM and AVR based MCUs.

- Programming of over 1000 NOR flash chips, NAND Flash, OneNAND Flash
- Programming of Data Flash, SPI Flash devices
- Programming of a JFFS2 image to a NAND Flash
- Working in standalone mode in the production line (with a MMC/SD card)
- Multi-core programming; upgrade to **PEEDI** JTAG Emulator

More information may be found at: <http://www.ronetix.at/flash-programmer.html>

4.15 RPM Systems

RPM System Corporation with **MPQ** Four-port In-circuit Gang Programmers provide programming support with:

- One image on up to four devices in parallel
- Up to 16 MPQ's can be interconnected to provide programming of up to 64 devices in parallel
- Up to four separate program images can be stored on the programmer, allowing optional stand-alone operation, and making programming fast and efficient
- Stand-alone, ATE-controlled, or PC-controlled operation
- Device Serialization feature allows automatic serialization of programmed devices
- Secure Image Management feature provides code security and allows restrictions on the number of parts programmed from each image
- Support for Atmel AVR, AVR32, and ARM devices
- Support for SPI, PDI, TPI, JTAG, and SWD Atmel programming interfaces
- More information at <http://www.rpmsys.com/products.htm>

4.16 SEGGER Microcontroller

In an effort to cover the programming needs during development, prototype creation, mass production and in the field services, SEGGER Microcontroller has created a broad product portfolio based on the **J-Link** family. The developer will benefit from the highest programming speed, unlimited breakpoints in flash memory and the freedom of choice regarding the development tool-chain, by selecting a **J-Link PLUS**, **J-Link ULTRA+**, **J-Link PRO**, or **J-Trace**.

For prototype creation the developer can use the **J-Link** tools or use the advanced production features offered in stand-alone mode by the **Flasher ARM**, which includes serial number and patch programming. The **Flasher ARM** also allows easy integration into a production environment by offering the interfaces USB, Ethernet, UART, or two-wire handshake.

In service situations the small form factor **Flasher Portable** is the model of choice. It operates stand alone, is powered by batteries, and can hold up to four different firmware images or programming settings simultaneously.

J-Link Debug Probes: <http://www.segger.com/debug-probes.html>

Flasher Production Programmer: <http://www.segger.com/flasher-arm.html>

Flasher Portable: <http://www.segger.com/flasher-portable.html>

4.17 SMH Technologies

SMH Technologies is a global, independent, high-tech company leader in Silicon Device In-System Programming and related services for the electronic boards manufacturing industry. **FlashRunner** series, the company's professional Silicon Device In-System Programming platform, is the result of the decennial experience in micro-code encoding for 8-, 16-, and 32-bit processors. **FlashRunner** helps customers enhance quality, save time and optimize manufacturing cycles. SMH continuously improve their offer by releasing new programming algorithms weekly. Thanks to **FlashRunner** flexible and modular design, the same algorithms to be used on all of the models.

FlashRunner I series: A range of high-performance In-System Programmers for Flash-based microcontrollers and serial memories. Targets production environments and works in full standalone mode or controlled by a host system.

FlashRunner Quattro is a high-integration in-system gang programmer, based on the FlashRunner technology, designed for programming multi-PCB panel assemblies.

FlashRunner FRPXIA3 is a PXI module for Gang In System Programming. First in the world programming solution for PXI system, and has full hardware and software ATE integration and multi-target parallel programming channels.

4.18 System General

In response to increasing customer demands for programming IC devices, System General provides total solutions in terms of manual and automated equipment primarily used for mass production. Currently System General supports more than 22,000 IC's from major IC manufacturers, including the Atmel AVR and ARM-based families. The supported IC list can be found at link below. As for automated solutions, the **AP710** is intended for handling small and fragile CSP package and serves as the universal programming platform, while the **AP720** is optimized for high volume production, carrying four nozzles and able to run with four programmers simultaneously. In addition, programming solutions support eMMC/NAND/NOR/MCU and CPLD devices and software updates are free of charge throughout the product life of the programming equipment!

System General Products: http://www.sg.com.tw/instruGP/product_E.asp

System General Chip List: http://www.sg.com.tw/instruGP/search_E.asp

4.19 Xeltek Inc.

Xeltek Inc. offers professional high-speed programming solutions for in-system production programming of AVR microcontrollers. **SuperPro IS01** is intended for small to medium scale production. **SuperPro IS03** and **SuperPro XPS01** are for large scale production and multiple **SuperPro IS03** units can be set up to program multiple microcontrollers in parallel, to save production time. All programming tools are controlled through the **SuperPro software**, and some can also be controlled by command line and LabVIEW. The **SuperPro software** has multi-language support including English, Chinese, German, French, and other languages.

SuperPro IS01 web page: <http://www.xeltek.com/In-System-Programmers/SuperPro-IS01/>

SuperPro IS03 web page: <http://www.xeltek.com/SuperPro-IS03-In-System-ISP-Programmer/>

SuperPro XPS01 web page: <http://www.xeltek.com/SuperPro-XPS01-ISP-Production-Workstation>

SuperPro software web page: <http://www.xeltek.com/SuperPro-Software-Download-Center/>

5. Programming Houses

Programming services are also available from distributors. Contact your distributor for more information about programming services.

Table 5-1. Other Programming Houses in Alphabetic Order (not limited to)

Company name	Products supported	Other devices
A&J Programming USA http://www.ajprogram.com/	AVR, ARM	Ink and laser marking, coplanarity check and inspection, dry pack.
Falcon Denshi K.K. Japan, China http://www.falcon-denshi.co.jp/en	SAM3, SAM4, SAMA5, SAM9	
HI-LO Electronics AB Sweden www.hilo.nu	AVR, ARM	Laser and ink marking. Repacking according to the customer's needs.
HI-LO SYSTEMS Taipei, TAIWAN http://www.hilosystems.com.tw/	AVR, ARM	Programming of NAND, Nor flash etc.
MDSemiconductor (Micro Delta System) KOREA www.mdsemi.co.kr	AVR, ARM, EEPROM	Programming of Memory and PLD.
MINATO ELECTRONICS INC. Japan, China http://www.minato.co.jp/en	SAM3, SAM4	
PROCHILD KOREA http://www.prochild.com	AVR, ARM	
Program Automation, Inc. USA http://www.progauto.com/	AVR, ARM	Programming of memories and FPGA.
Xeltek CHINA http://www.xeltek.com.cn/en	AT89C51, AVR, SAM7, SAM3, SAM4, SAM D20	Programming of PLD, GAL.

6. How to Register as Third Party Vendor

To register programming tools for Atmel microcontroller products, contact Atmel technical support through the technical support portal: <http://www.atmel.com/design-support>.

7. Revision History

Doc. Rev.	Date	Comments
42215C	01/2015	SMH details added
42215B	01/2014	EE Tools, Dataman, and Segger added
42215A	11/2013	Initial document release

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